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EFFICIENT ALGORITHMS AND DATA STRUCTURES IN GEOMETRIC DESIGN

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13. ABSTRACT (Maximum 200 words)

An efficient and uniform approach for the automatic reconstruction of surfaces of CAD models, and scolar field defined on them, from an unorganized collection of scanned point data has been developed.

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Final Technical Report F49620-93-1-0138
(1 Jan 95 - 31 March 95)

Project Title: Efficient Algorithms and Data Structures in Geometric Design
PI Name (Last, First, MI): __Bajaj, Chandrajit, L.__
Institution: __Purdue University ___

1. Developed an efficient and uniform approach for the automatic reconstruction of surfaces of CAD (computer aided design) models and scalar fields defined on them, from an unorganized collection of scanned point data. Example applications in the manufacturing domain are the rapid computer model reconstruction of any existing physical part from some three dimensional (3D) points scan of the part's surface. Color, texture or some scalar material property of the physical part, defines natural scalar fields over the surface of the CAD model. Manufacturers who wish to use existing computer aided design and manufacturing software (CAD/CAM) need to have computer models of these parts. Using these algorithms, existing parts and prototypes can be automatically reconstructed into computer models from 3D scans.

This work resulted in the publication below:

''Automatic Reconstruction of Surfaces and Scalar Fields from 3D Scans'',
(with F. Bernardini, G. Xu),
Proc. of 1995 ACM Symposium on Graphics, SIGGRAPH 95, Los Angeles, California, Computer Graphics, 29, 2, (1995).

2. Developed an algorithm using ''blossoming'' for a sparse and smooth connection between B\'{e}zier or Bspline curves.
Often in interactive font design, free-form sketching and input path specification for graphics animation, one is faced with the problem of connecting two B\'{e}zier or B-spline polynomial curves with a piecewise transition polynomial curve achieving prescribed continuity at the two end points.
Furthermore one desires the transition polynomial curve to have the fewest number of pieces (sparse).
This issue is addressed by first identifying degrees of freedom needed to achieve the conditions for smoothness and sparseness.

This work resulted in the publication below:

''Sparse Smooth Connection between B\'{e}zier/Bspline Curves'',
(with G. Xu)
Graphics Gems V,
edited by A. Paeth, Academic Press, New York, (1995).

HONORS/AWARDS RECEIVED DURING ABOVE CONTRACT/GRANT PERIOD

1. Elected Program Committe Member of the Eurographics workshop on Implicit Surfaces, Implicit'95, France, 1995.

2. Elected Program Committe Member of workshop on Algorithms and Data Structures, WADS'95, 1995.